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09/761,921	01/17/2001	Gary W. Scott	NBD-46/47181-00193USP1	5556

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Larry I. Golden  
Intellectual Property Dept.  
Square D Company  
1415 South Roselle Road  
Palatine, IL 60067

EXAMINER

WEST, JEFFREY R

ART UNIT PAPER NUMBER

2857

DATE MAILED: 12/15/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/761,921

Applicant(s)

SCOTT, GARY W.

Examiner

Jeffrey R. West

Art Unit

2857

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 06 October 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-40 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-40 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 06 May 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
- a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Priority***

1. The applicant has not complied with one or more conditions for receiving the benefit of an earlier filing date under 35 U.S.C. 120 as follows:

The second application must be an application for a patent for an invention which is also disclosed in the first application (the parent or provisional application); the disclosure of the invention in the parent application and in the second application must be sufficient to comply with the requirements of the first paragraph of 35 U.S.C. 112. See *Transco Products, Inc. v. Performance Contracting, Inc.*, 38 F.3d 551, 32 USPQ 2d 1077 (Fed. Cir. 1994). The disclosure of the 09/426,832 application does not provide sufficient support for the instant invention because there is no current sensor operatively associated with a pair of substantially identical parallel insulated load conductors for each zone in which arcing is to be detected.

### ***Claim Rejections - 35 USC § 103***

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1, 2, 9, 13, 14, 17, 18, 25, 29, 30, and 33-40 are rejected under 35

U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,986,860 to Scott in view of U.S. Patent No. 3,857,069 to Howell.

Scott discloses a method and corresponding detection system for detecting series and parallel arcing faults in a defined zone of an electrical circuit supplying electrical power to a load (column 2, lines 60-64) comprising splitting a conductor in each said defined zone into a single pair of substantially identical parallel insulated conductors, thereby defining a detection zone comprising the length of said parallel conductors between terminating end points where the two conductors are electrically coupled together, providing a current sensor (i.e. toroidal transformer current sensor) operatively associated with each said pair of parallel conductors, and configuring and arranging the current sensor such that the current sensor produces a signal representative of a difference in the current flow in the two conductors (column 3, lines 25-40 and Figure 4). Scott also discloses that the current sensor comprises a  $di/dt$  (i.e. time derivate of current) air core toroid (column 10, lines 26-29), a figure-8 shaped core (column 9, lines 6-11), or at least a magnetic core, provided with a wound coil, coupled with the conductors in such a way that the currents travel in opposite directions, and therefore it is considered inherent that the magnetic fields will also oppose each other (column 8, lines 35-41).

Scott discloses an arc fault detector, operatively coupled with the current sensors, that produces a signal indicating an arc fault which is supplied as a trip signal to trip a circuit breaker (column 7, lines 23-41), a RC shunt filter to mask the effects on  $di/dt$  due to different load power factors (column 10, lines 53-63), and an

over-pressure relay to detect faults to ground (column 12, lines 48-52). Scott also discloses that during differential phase current arc detection the detection zone is defined by a pair of identical parallel insulated conductors that each carry a load current (column 8, lines 23-41).

Scott also discloses, with respect to Figure 4, the aforementioned embodiment comprising two parallel load conductors coupled at either end of the detection zone. With reference to Figure 4, it is considered inherent that each of the parallel conductors will carry substantially half the total phase current during normal operating conditions since the Figure shows splitting the current between the two conductors and Scott discloses that the current differential between the conductors detected by the current sensor is zero under normal conditions (i.e. the split currents are substantially equal) (column 8, lines 41-43). Further, since the phase currents on the two split conductors ("82" and "84") are substantially half the current of the initial load conductor ("86"), it would have been obvious to one having ordinary skill in the art to specify that the split conductors are essentially half the size of the required size of a single load conductor since the diameter of a wire and its maximum current rating have a direct relationship and the modification would have provided the most efficient wire size for the corresponding amount of current carried through the wire.

With respect to claims 2 and 18, Scott teaches many of the features of the claimed invention including a transformer current sensor with a magnetic core but is silent on the permeability of the core. Although not specifically disclosed, it would have been obvious to one having ordinary skill in the art to include a high

permeability core because it is well known in the art that to achieve a given inductance without a high permeability core, more and/or larger turns of the coil would be needed and therefore a core with high permeability would have provided a desired inductance using a smaller transformer to meet space constraints.

With respect to claims 36, 37, 39, and 40, the limitations for including the system in an aircraft are considered to be intended use. A recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. See *In re Casey*, 152 USPQ 235 (CCPA 1967) and *In re Otto*, 136 USPQ 458, 459 (CCPA 1963). In the instant case, the structure of Scott is applicable in an aircraft system since it includes embodiments for detecting line-to-line arc faults as well as detecting arcs generating frequency components from DC to the megahertz range and beyond. Further, in such a use it is considered well-known in the art to use the frame of the plane as a neutral return to eliminate extra weight (See Applicants Admitted Prior Art in the background of the invention (page 7, lines 23-13) and U.S. Patent No. 5,894,393 to Elliott et al. (column 1, lines 21-31)).

As noted above, Scott teaches all the features of the claimed invention except for including a balancing core operatively associated with the pair of parallel load conductors that provide a differential current unbalance by inducing canceling impedances.

Howell teaches a fault interrupter circuit comprising two parallel line and neutral conductors passing through a differential current transformer and a second auxiliary/balancing core (column 4, lines 9-24) wherein the auxiliary/balancing core provides a detectable current unbalance in the presence of a parallel fault by inducing signals (column 3, lines 12-20) that cancel impedances in the parallel conductors (column 3, lines 21-31 and column 8, lines 64-68).

It would have been obvious to one having ordinary skill in the art to modify the invention of Scott to include a balancing core operatively associated with the pair of parallel load conductors that provide a differential current unbalance by inducing canceling impedances, as taught by Howell, because Howell suggests that the combination would have provided fail-safe circuit interruption by producing a fault condition in situations when a de-sensitized fault occurs that would normally not provide the necessary interruption (column 3, lines 21-43).

4. Claims 3 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Scott in view of Howell and further in view of U.S. Patent No. 3,914,667 to Waldron.

As noted above, the invention of Scott and Howell teaches all the features of the claimed invention except for specifying that the current sensor comprise a Hall effect sensor.

Waldron teaches a sensing and tripping means for protecting a circuit against damage from overload conditions and preventing erroneous circuit breaker tripping operations due to transient conditions which may occur during normal operation

(column 2, lines 5-11) comprising a Hall effect sensor that produces an output voltage directly proportional to the current flow through a conductor generating a magnetic field concentrated by a magnetic core. (column 2, lines 41-53).

It would have been obvious to one having ordinary skill in the art to modify the invention of Scott and Howell to include specifying that the current sensor comprise a Hall effect sensor, as taught by Waldron, because, as suggested by Waldron the combination would have provided a means for developing a voltage signal proportional to the current flow which, when in voltage form, can be used to insure that breaker tripping only occurs when a desired condition is met (column 2, lines 5-19).

5. Claims 4-6 and 20-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Scott in view of Howell and further in view of U.S. Patent Application Publication No. 2002/0011832 A1 to Berkcan et al.

As noted above, the invention of Scott and Howell teaches many of the features of the claimed invention including specifying that the current sensor comprise a  $di/dt$  air coil toroid or be formed into a figure-8 configuration, but does not teach that the  $di/dt$  sensor be of low permeability or that the figure-8 sensor use a Rogowski coil.

Berkcan teaches primary current conductor configurations for a residential electronic meter comprising a current sensor assembly including a sensor coil, an electrostatic shield coil, a toroid core of non-magnetic material, a housing, and a magnetic shield all arranged coaxially about a pair of primary current conductors

(0007 and 0008) wherein the sensing coil is a Rogowski coil and the core is an air core (0024). Berkcan also teaches that an air core, such as the core disclosed by Scott, is one of low permeability (0010).

It would have been obvious to one having ordinary skill in the art to modify the invention of Scott and Howell to include specifying that the current sensor use a Rogowski coil, as taught by Berkcan, because, as suggested by Berkcan the combination would have given an isolated current measurement using a coil that does not saturate with high fields and has an excellent bandwidth and linearity (0024).

6. Claims 7 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Scott in view of Howell and Berkcan and further in view of U.S. Patent No. 6,088,205 to Neiger.

As noted above, Scott in combination with and Howell and Berkcan teaches many features of the claimed invention including a RC shunt filter as well as a current sensor that produces a signal proportional to the difference between the time derivatives of the current in two conductors, but does not teach specifying a circuit for integrating and filtering to produce the current signal.

Neiger teaches an arc fault detector with circuit interrupter comprising an AFCI/GFCI circuit including two current transformers consisting of magnetic cores and coils (column 8, lines 61-63) and a toroidal current to voltage transformer (column 9, lines 58-60) wherein the output of the toroidal transformer is input to two

separate circuits, one circuit being high frequency comprising a high pass filter, full wave rectifier, amplifier, and integrator, and the second circuit being the AC line frequency circuit comprising a low pass filter, full wave rectifier, amplifier, and integrator (column 10, lines 22-28).

It would have been obvious to one having ordinary skill in the art to modify the invention of Scott, Howell, and Berkcan to include specifying a circuit for integrating and filtering to produce the current signal, as taught by Neiger, because, as suggested by Neiger, the combination would have provided a method for splitting of the output signal from the transformer into two signals of different frequencies to permit the device to react to different combinations of AC line frequency and high frequency arcing signals and therefore permitted the AFCI circuit to react appropriately to many different arcing situations (column 10, lines 26-33) with the integrator generating the necessary signal representative of the level of the average peak arc current present on the AC line (column 12, lines 18-20).

7. Claims 8 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Scott in view of Howell and further in view of U.S. Patent No. 5,420,504 to Berkcan:

As noted above, the invention of Scott and Howell teaches many of the features of the claimed invention including a RC shunt as well as a current sensor to determine the difference in current between two conductors, but does not teach

measuring the current signal using a current sensor comprising a resistive shunt that produces a voltage difference proportional to the measured current signal.

Berkcan teaches a current measuring system that uses a measurement of voltage for assessing the value of the current (column 2, lines 25-29) comprising a non-inductive current sensor that determines the sensed current using the voltage drop or voltage difference across the resistive shunt between a pair of contact points (column 4, lines 6-11).

It would have been obvious to one having ordinary skill in the art to modify the invention of Scott and Howell to include measuring the current signal using a current sensor comprising a resistive shunt that produces a voltage difference proportional to the measured current signal, as taught by Berkcan, because, as suggested by Berkcan, the combination would have provided a sensor that can be used in a three-phase network, or other configuration with more than one sensor employed in close proximity, while reducing or substantially eliminating the mutual coupling effects that may degrade the quality of the sensor current measurements (column 4, lines 20-35).

8. Claims 10-12, 15, 26-28, and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Scott in view of Howell and further in view of U.S. Patent No. 5,519,561 to Mrenna et al.

As noted above, the invention of Scott and Howell teaches all the features of the

claimed invention except for a circuit breaker using a bi-metal current sensor and armature that moves (i.e. is attracted) by the magnetic core in response to the current difference.

Mrenna teaches an electrical system protected, by a circuit breaker, that includes a line conductor and a neutral conductor connected to provide power to a load wherein the breaker includes a thermal magnetic overcurrent detector comprising a bimetal connected in series with the line conductor. Mrenna then teaches that persistent overcurrents bend the bi-metal causing it to release a hatch which actuates the trip mechanism as well as that short circuits passing through the bimetal magnetically attract an armature to release the latch and actuate the trip mechanism (column 3, lines 15-28). Mrenna also teaches an arc detector that sends a trip signal to the breaker in response to the reception of a bandwidth limited di/dt signal a predetermined number of times (column 3, line 62 to column 4, line 2).

It would have been obvious to one having ordinary skill in the art to modify the invention of Scott and Howell to include a circuit breaker using a bi-metal current sensor and armature that moves (i.e. is attracted) by the magnetic core in response to the current difference, as taught by Mrenna, because Mrenna suggests a circuit breaker sensor, applicable as the breaker disclosed in the invention of Scott, that would have produced accurate current measurements inexpensively and without excessive space (column 2, lines 1-19).

9. Claims 16 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable

over Scott in view of Howell and further in view of U.S. Patent No. 5,905,619 to Jha.

As noted above, the invention of Scott and Howell teaches all the features of the claimed invention except for including a relay, responsive to the differential current, coupled to the circuit breaker for its operation.

Jha teaches an arc fault detection system comprising a circuit electrically connected between a power source and a switchboard, a control power source for a differential current relay, a source current transformer coupled to the electrical circuit between a circuit breaker and the switchboard wherein the differential current relay is electrically connected to the breaker such that when the differential current relay determines a differential current it opens the breaker (column 1, lines 45-62)

It would have been obvious to one having ordinary skill in the art to modify the invention of Scott and Howell to include a relay, responsive to the differential current, coupled to a circuit breaker for its operation, as taught by Jha, because, as suggested by Jha, the combination would have provided a current detection system reduces the occurrence of unwanted breaker tripping by only receiving current through the operating coils when an arc fault occurs and not during normal operation (column 1, line 66 to column 2, line 10).

### ***Response to Arguments***

10. Applicant's arguments filed 06 October 2003 have been fully considered but they are not persuasive.

Applicant argues the combination of Scott and Howell because "[t]he teachings of Howell are very similar to many present ground-fault-circuit-interrupter circuits. Scott, however, relates to arc fault detectors, not ground-fault detectors. One skilled in the art, therefore, would not make a combination of Scott and Howell."

The Examiner asserts that as long as a prior art reference is either in the field of applicant's endeavor or, if not, is reasonably pertinent to the particular problem with which the applicant was concerned, the reference can properly be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, each of the instant invention, Scott references, and Howell references are concerned with the problem of electrical fault detection.

Further, the Examiner notes that arc-fault detection and ground-fault detection are often used in combination (See for example, U.S. Patent No. 5,889,643 to Elms).

Applicant then argues that "[t]he invention of Howell requires both a neutral ground wire and a load wire coupled with two toroids. . . Without a neutral wire the Howell patent has no application, and thus cannot be combined with Scott, which has no neutral wire. Furthermore, if the Howell method were mistakenly applied to only the line conductor(s) of Scott, as the Examiner suggests, the resulting combination would only sense the connected load impedance-to-frame or a 4 ohm or less line-to-frame fault. This is not useful."

The Examiner maintains that the invention of Howell is only included to teach the application of an auxiliary/balancing core to the system of Scott, not to incorporate the entire system of Howell into the system of Scott. Further, this teaching of Howell has desirability in the invention of Scott because by adding the auxiliary/balancing core of Howell to the existing system of Scott would have provided fail-safe circuit interruption by producing a fault condition in situations when a de-sensitized fault occurs that would normally not provide the necessary interruption (column 3, lines 21-43).

Applicant also argues that "[t]he mere existence of the secondary toroidal core auxiliary transformer 24 in Howell, does not suggest the balancing core of the present invention or its electrical relationship with the pair of load conductors and the current sensor of the present invention." Applicant, however, has failed to sufficiently explain why the toroidal core auxiliary transformer of Howell does not meet the limitation of a balancing core. The Examiner maintains that claims 1 and 35 only require "a balancing core operatively associated with a pair of parallel load conductors" and the combination of Scott and Howell provides splitting a conductor in each said defined zone into a single pair of substantially identical parallel insulated conductors, providing a current sensor (i.e. toroidal transformer current sensor) operatively associated with each said pair of parallel conductors (Scott, column 3, lines 25-40 and Figure 4) and specifying that the detection zone is defined by a pair of identical parallel insulated conductors that each carry a load current

(Scott, column 8, lines 23-41) in combination with two parallel line and neutral conductors passing through a differential current transformer and a second auxiliary/balancing core (Howell, column 4, lines 9-24) wherein the auxiliary/balancing core provides a detectable current unbalance in the presence of a parallel fault by inducing signals (Howell, column 3, lines 12-20) that cancel impedances in the parallel conductors (Howell, column 3, lines 21-31 and column 8, lines 64-68).

Applicant then argues the combination of Waldron with the invention of Scott and Howell because "the combination of a Hall effect sensor with the invention of Howell itself produces an unworkable solution. Such a combination would reduce the effectiveness of the sensing core of Howell and, instead of sensing a 5 ma fault, it might begin to sense at 5 amps. The ground-to-neutral oscillatory circuit would, instead of finding 4 ohms, find perhaps a 0.004 ohm fault. Neither of these results is useful or appropriate in circuit fault detectors. Thus combining the active circuitry as taught by Howell with Scott and Waldron can be seen to have undesirable results."

Similar to the explanation provided above, the Examiner asserts that the invention of Waldron is only included to teach specifying that the current sensor comprise a Hall effect sensor in the system of Scott not to incorporate the entire system of Waldron, including an oscillatory circuit, into the system of Scott.

Applicant also argues the combination of Neiger with the invention of Scott, Howell, and Berkcan because "the circuit of Neiger cannot be combined with that of Scott alone, or Scott and Berkcan, for many of the same reasons as discussed with respect to the operation of the circuit of Howell. The circuit of Neiger also requires sensing of the load and neutral lines and cannot be used to monitor the bifurcated load lines used in Scott."

The Examiner maintains that the invention Neiger is only included to teach a circuit for integrating and filtering to produce the current signal. As shown in Figures 6 and 7 of Neiger, the filtering and integrating circuit only performs operations on the already sensed current outputs from current transformers. This operation is not dependent on the type of lines being monitored, only on the output of the transformers, and would perform the same operation on a line-line system or a line-neutral system. Therefore, the filtering and integrating operations can properly be performed on the output of the current sensor present in the invention of Scott, Howell, and Berkcan.

### ***Conclusion***

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

U.S. Patent No. 5,889,643 to Elms teaches an apparatus for detecting arcing faults and ground faults in multi-wire branch electric power circuits.

U.S. Patent No. 6,633,467 to Macbeth et al. teaches an arc fault current interrupter which detects and interrupts line side arcing.

U.S. Patent No. 6,628,487 to Macbeth teaches a method and apparatus for detecting upstream series arc faults.

**12. THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

**13.** Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeffrey R. West whose telephone number is (703)308-1309. The examiner can normally be reached on Monday through Friday, 8:00-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Marc S. Hoff can be reached on (703)308-1677. The fax phone

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numbers for the organization where this application or proceeding is assigned are (703)308-7382 for regular communications and (703)308-7382 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0956.

jr  
December 5, 2003

  
MARC S. HOFF  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2800